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The HYDROMED model and its application to semi-arid Mediterranean catchments with hill reservoirs 3: Reservoir storage capacity and probability of failure model

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Abstract. This paper addresses the issue of "what reservoir storage capacity is required to maintain a yield with a given probability of failure?". It is an important issue in terms of construction and cost. HYDROMED offers a solution based on the modified Gould probability matrix method. This method has the advantage of sampling all years data without reference to the sequence and is therefore particularly suitable for catchments with patchy data. In the HYDROMED model, the probability of failure is calculated on a monthly basis. The model has been applied to the El-Gouazine catchment in Tunisia using a long rainfall record from Kairouan together with the estimated Hortonian runoff, class A pan evaporation data and estimated abstraction data. Generally, the probability of failure differed from winter to summer. Generally, the probability of failure approaches zero when the reservoir capacity is 500,000 m^3. The 25% probability of failure (75% success) is achieved with a reservoir capacity of 58,000 m^3 in June and 95,000 m^3 in January. The probability of failure for a 240,000 m^3 capacity reservoir (closer to storage capacity of El-Gouazine 233,000 m^3), is approximately 5% in November, December and January, 3% in March, and 1.1% in May and June. Consequently there is no high risk of El-Gouazine being unable to meet its requirements at a capacity of 233,000 m^3. Subsequently the benefit, in terms of probability of failure, by increasing the reservoir volume of El-Gouazine to greater than the 250,000 m^3 is not high. This is important for the design engineers and the funding organizations. However, the analysis is based on the existing water abstraction policy, absence of siltation rate data and on the assumption that the present climate will prevail during the lifetime of the reservoir. Should these conditions change, a new analysis should be carried out.

Keywords: HYDROMED, reservoir, storage capacity, probability of failure, Mediterranean

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